

Claims

[c1] What is claimed is:

1.A method for controlling an interpolation direction of a pixel needing to be interpolated between a first row and a second row within an image, the image having a plurality of pixels arranged in a matrix format, the method comprising:

(a) calculating a plurality of first horizontal pixel value differences between pixels positioned in the first row and a plurality of second horizontal pixel value differences between pixels positioned in the second row, wherein the first and second horizontal pixel value differences respectively correspond to opposite quadrants of the image with the pixel needing to be interpolated being an origin; and

(b) comparing the plurality of first horizontal pixel value differences with a first threshold and the plurality of second horizontal pixel value differences with a second threshold to control whether the interpolation direction is orthogonal to the first row and the second row.

[c2] 2.The method of claim 1, wherein step (b) controls whether the interpolation direction is orthogonal to the

first row and the second row according to at least one of the following steps (b-1), (b-2), and (b-3):

(b-1) if any of the plurality of first horizontal pixel value differences is greater than the first threshold and any of the plurality of second horizontal pixel value differences is greater than the second threshold, controlling the interpolation direction not to be orthogonal to the first and the second rows, otherwise, controlling the interpolation direction to be orthogonal to the first and the second rows;

(b-2) if none of the plurality of first horizontal pixel value differences is greater than the first threshold or none of the plurality of second horizontal pixel value differences is greater than the second threshold, controlling the interpolation direction to be orthogonal to the first and the second rows, otherwise, controlling the interpolation direction not to be orthogonal to the first and the second rows; and

(b-3) if any of the plurality of first horizontal pixel value differences is greater than the first threshold and any of the plurality of second horizontal pixel value differences is greater than the second threshold, controlling the interpolation direction not to be orthogonal to the first and the second rows, and if none of the plurality of first horizontal pixel value differences is greater than the first threshold or none of the plurality of second horizontal

pixel value differences is greater than the second threshold, controlling the interpolation direction to be orthogonal to the first and the second rows.

- [c3] 3.The method of claim 1, further comprising:
 - (c) generating the interpolation direction corresponding to the pixel needing to be interpolated according to a directional interpolation process.
- [c4] 4.The method of claim 1, wherein the first threshold is equal to the second threshold.
- [c5] 5.The method of claim 1, wherein the first row is adjacent to the second row.
- [c6] 6.The method of claim 5, wherein:
 - step (a) further comprises calculating a plurality of third horizontal pixel value differences between pixels positioned in a third row and a plurality of fourth horizontal pixel value differences between pixels positioned in a fourth row, wherein the third and fourth horizontal pixel value differences respectively correspond to opposite quadrants of the image with the pixel needing to be interpolated being the origin; and
 - step (b) further comprises comparing the plurality of third horizontal pixel value differences with a third threshold and the plurality of fourth horizontal pixel

value differences with a fourth threshold to control whether the interpolation direction is orthogonal to the first, second, third, and fourth rows.

[c7] 7.The method of claim 6, wherein the first and second rows are positioned between the third and fourth rows.

[c8] 8.The method of claim 7, wherein the first, second, third, and fourth rows correspond to four successive rows.

[c9] 9.The method of claim 1, wherein:
step (a) further comprises calculating a plurality of third horizontal pixel value differences between pixels positioned in a third row and a plurality of fourth horizontal pixel value differences between pixels positioned in a fourth row, wherein the third and fourth horizontal pixel value differences respectively correspond to opposite quadrants of the image with the pixel needing to be interpolated being the origin; and
step (b) further comprises comparing the plurality of third horizontal pixel value differences with a third threshold and the plurality of fourth horizontal pixel value differences with a fourth threshold to control whether the interpolation direction is orthogonal to the first, second, third, and fourth rows.

[c10] 10.The method of claim 1, wherein step (a) calculates the

first horizontal pixel value differences through a repeated use of pixel with other pixels positioned in the first row.

[c11] 11.The method of claim 1, wherein step (a) calculates the second horizontal pixel value differences through a repeated use of pixel with other pixels positioned at the second row.

[c12] 12.The method of claim 1, wherein step (a) calculates each of the second horizontal pixel value differences from adjacent pixels.

[c13] 13.The method of claim 1, wherein step (a) calculates each of the first horizontal pixel value differences from adjacent pixels, and calculates each of the second horizontal pixel value differences from adjacent pixels.

[c14] 14.A device for controlling an interpolation direction of a pixel needing to be interpolated between a first row and a second row within an image, the image having a plurality of pixels arranged in a matrix format, the device comprising:

an arithmetic unit for calculating a plurality of first horizontal pixel value differences between pixels positioned in the first row and a plurality of second horizontal pixel value differences between pixels positioned in the sec-

ond row, wherein the first and second horizontal pixel value differences respectively correspond to opposite quadrants of the image with the pixel needing to be interpolated being an origin; and
a processing unit electrically connected to the arithmetic unit for controlling the interpolation direction, the processing unit comparing the plurality of first horizontal pixel value differences with a first threshold and the plurality of second horizontal pixel value differences with a second threshold to control whether the interpolation direction is orthogonal to the first row and the second row.

- [c15] 15. The device of claim 14, wherein the processing unit controls whether the interpolation direction is orthogonal to the first row and the second row according to at least one of the following steps (a-1), (a-2), and (a-3):
(a-1) if any of the plurality of first horizontal pixel value differences is greater than the first threshold and any of the plurality of second horizontal pixel value differences is greater than the second threshold, controlling the interpolation direction not to be orthogonal to the first and the second rows, otherwise, controlling the interpolation direction to be orthogonal to the first and the second rows;
(a-2) if none of the plurality of first horizontal pixel value differences is greater than the first threshold or

none of the plurality of second horizontal pixel value differences is greater than the second threshold, controlling the interpolation direction to be orthogonal to the first and the second rows, otherwise, controlling the interpolation direction not to be orthogonal to the first and the second rows; and

(a-3) if any of the plurality of first horizontal pixel value differences is greater than the first threshold and any of the plurality of second horizontal pixel value differences is greater than the second threshold, controlling the interpolation direction not to be orthogonal to the first and the second rows, and if none of the plurality of first horizontal pixel value differences is greater than the first threshold or none of the plurality of second horizontal pixel value differences is greater than the second threshold, controlling the interpolation direction to be orthogonal to the first and the second rows.

[c16] 16. The device of claim 14, wherein the device is electrically coupled to a directional interpolation unit, and the processing unit generates the interpolation direction corresponding to the pixel needing to be interpolated according to a temporary direction generated by the directional interpolation unit.

[c17] 17. The device of claim 16, wherein the arithmetic unit and/or the processing unit are installed in the directional

interpolation unit.

[c18] 18. The device of claim 14, wherein the arithmetic unit and the processing unit are integrated into one module.

[c19] 19. The device of claim 14, wherein:
the arithmetic unit is capable of calculating a plurality of third horizontal pixel value differences between pixels positioned in a third row and a plurality of fourth horizontal pixel value differences between pixels positioned in a fourth row, wherein the third and fourth horizontal pixel value differences respectively correspond to opposite quadrants of the image with the pixel needing to be interpolated being the origin; and
the processing unit is capable of comparing the plurality of third horizontal pixel value differences with a third threshold and the plurality of fourth horizontal pixel value differences with a fourth threshold to control whether the interpolation direction is orthogonal to the first, second, third, and fourth rows.

[c20] 20. A method for determining an interpolation direction of a designated pixel located between a first row of horizontal pixels and a second row of horizontal pixels within an image, the method comprising:
(a) obtaining first values representing differences between pairs of at least some of the first row of horizontal

pixels, and obtaining second values representing differences between pairs of at least some of the second row of horizontal pixels; and

(b) comparing the first values with a first threshold and the second values with a second threshold to determine whether the interpolation direction is orthogonal to the first row and the second row.

[c21] 21. The method of claim 20, wherein the first values are obtained by calculating luminance or chrominance values of the first and second rows of horizontal pixels.

[c22] 22. The method of claim 20, wherein step (b) determine whether the interpolation direction is orthogonal to the first row and the second row according to at least one of the following steps (b-1), (b-2), and (b-3):
(b-1) if any of the first values is greater than the first threshold and any of the second values is greater than the second threshold, controlling the interpolation direction not to be orthogonal to the first and the second rows, otherwise, controlling the interpolation direction to be orthogonal to the first and the second rows;
(b-2) if none of the first values is greater than the first threshold or none of the second values is greater than the second threshold, controlling the interpolation direction to be orthogonal to the first and the second rows, otherwise, controlling the interpolation direction not to

be orthogonal to the first and the second rows; and
(b-3) if any of the first values is greater than the first threshold and any of the second values is greater than the second threshold, controlling the interpolation direction not to be orthogonal to the first and the second rows, and if none of the first values is greater than the first threshold or none of the second values is greater than the second threshold, controlling the interpolation direction to be orthogonal to the first and the second rows.